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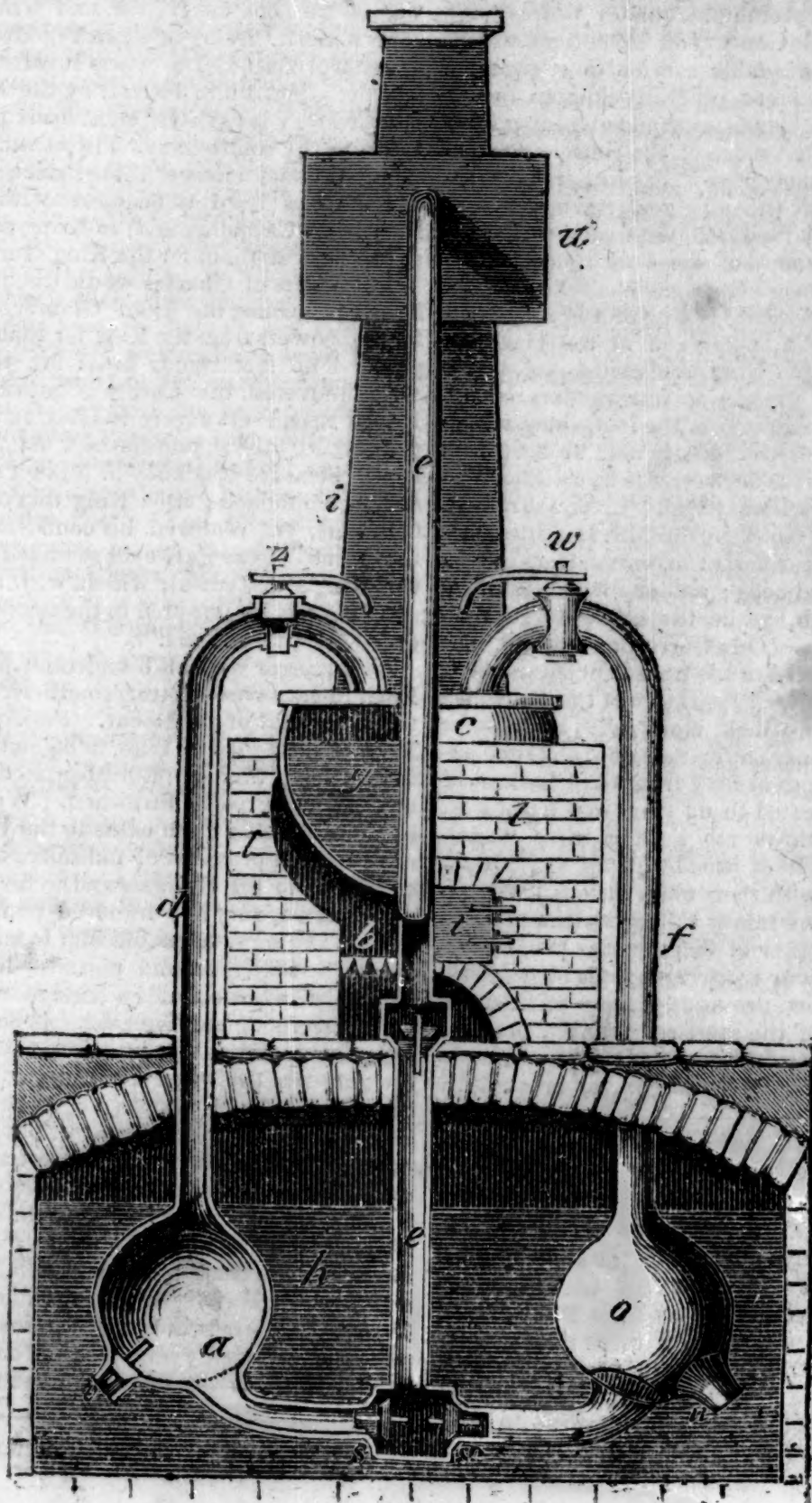
"The most valuable gift which the Hand of Science has ever  
yet offered to the Artisan." *Dr. Birkbeck.*

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## LORD WORCESTER'S STEAM ENGINE.



**A Century of the Names and Scantlings of such Inventions as at present I can call to mind to have tried and perfected, which (my former Notes being lost) I have, at the instance of a powerful friend, endeavoured now, in the year 1655, to set down in such a way as may sufficiently instruct me to put any of them in practice. (1)**

“*Artis et Naturæ proles.*”

We were indebted, some time since, to an intelligent Correspondent (S. R.) for the suggestion that the republication, in our pages, of the Marquis of Worcester's celebrated *Century of Inventions* would render a valuable service to science, by making it more generally known to the mass of the community, and obtaining for it in particular, more of the consideration of practical men than it has hitherto received; and, by the same gentleman, we were also kindly favoured with a correct transcript of a copy of the work in his possession, which we have since collated with a copy in the hand-writing of the noble author himself, preserved in the Harleian MSS., at the British Museum, vol. 2428, and now present to our readers entire. From the readings in the foot-notes, which are those of the MS., it will be seen that the variations between the two authorities are mostly immaterial. In one instance, however (No. 88,) the MS. has substituted quite a different invention from that in the printed copy; and one which is credible enough, while the other beggars all conception. Our Correspondent (S. R.) has appended to his transcript a number of original notes, illustrative of the Marquis's inventions, which, along with some other illustrations in our possession, and such additional ones as may from time to time be communicated to us (inviting hereby all who can throw any light on these “summary heads of wonderful things,” to favour us with their observations,) we propose to give in our subsequent numbers.

The author of this singular production, of whom our readers may not be displeased to know, previously, some particulars, was one of the most remarkable political characters of his age. He was “the famous Earl of Glamorgan, so created by

Charles the First while heir-apparent to the Marquis of Worcester. He was a bigoted Catholic, but in times when that was no disrecommendation, and when it grew a merit. Being of a nature extremely enterprising, and a warm loyalist, he was despatched into Ireland by the King. Here history lays its finger, at least is interrupted by controversy. The censures of King Charles charge that Prince with sending this Lord to negotiate with the Irish rebel Catholics, and to bring over a great body of them for the King's service. The devotees of Charles would disculpate him and accuse the Lord Glamorgan of forging powers from the King for that purpose. The fact stands thus: the treaty was discovered, the Earl was imprisoned by the King's servants in Ireland, and was dismissed by them, unpunished, before the King's pleasure was known. The Parliament complained; the King disavowed the Earl, yet renewed his confidence in him; nor did the Earl ever seem to resent the King's disavowal, which, with much good nature, he imputed to the necessities of his Majesty's affairs.”\*

The King, “with all his affection for the Earl, in one or two letters to others, mentions his want of judgment. Perhaps his Majesty was glad to trust to his indiscretion. With *that* his Lordship seems (to have been) greatly furnished. We find him taking oaths upon oaths to the Pope's nuncio, with promises of unlimited obedience both to his Holiness and to his delegate, and begging five hundred pounds of the Irish Clergy, to enable him to embark and fetch fifty thousand pounds—like an alchemist, who demands a trifle of money for the secret of making gold. In another letter he promises two hundred thousand crowns, ten thousand arms for foot, two thousand cases of pistols, eight hundred barrels of powder, and thirty or forty well provided ships!! when he had not a groat in his purse, or as much gunpowder as would scare a corbie! It is certain that he and his father wasted an immense sum in the King's cause; of all which merits and zeal his Majesty was so sensible, that he gave the Earl the most extraordinary patent, perhaps, that ever was granted; the chief powers of which were to make him

(1.) The following is the title in the MS. copy of the work, afterwards mentioned: From Aug. ye 29th to Sept. ye 21st, 1659.

**A Centurie of the Names and Scantlings of such Inventions as att present I can call to mynde to have tryed and perfected my former Notes being lost: I have endeavoured to sett these down in such a way as may sufficiently instruct me to putt any of them in practice, having wherewith to do it.**

\* Walpole's Royal and Noble Authors.



Generalissimo of three armies and Admiral, with nomination of his officers, to enable him to raise money by selling his Majesty's woods, wardships, customs and prerogatives, and to create, by blank patents, to be filled up at Glamorgan's pleasure, from the rank of Baronet to that of Marquis. If any thing could justify the delegation of such authority, besides his Majesty having lost all authority when he conferred it, it was the promise with which the King concluded, of bestowing the Princess Elizabeth on Glamorgan's son. It was time to adopt into his family when he had into his sovereignty. This patent the Marquis, after the Restoration, gave up to the House of Peers. He did not long survive that era, dying in 1667.\*

The Marquis's Century of Inventions, which we are now to lay before our readers, was first printed in 12mo., in 1783. Walpole is pleased to designate it as an "amazing piece of folly;" but later and better informed writers have been led to think differently of it. Granger remarks—"That a practical mathematician, who has quickness to seize a hint and sagacity to apply it, might avail himself greatly of these Scantlings, though little more than a bare catalogue." And the same writer was informed by the late Reverend and ingenious mechanic, Mr. Gainsborough, of Henley, brother to the celebrated painter, that the Marquis's work was far from being such a collection of whims and chimeras as it has been supposed to be, and that, on the contrary, "he highly esteemed the author as one of the greatest mechanical geniuses that ever appeared in the world." It is quite certain, too, that since his time several of his "inventions" or suggestions have been reduced to practice; and hence the whole have become entitled to be treated with more respect. Professor Robison goes so far even as to affirm, that the steam-engine, the greatest discovery of modern times, "was, beyond all doubt, invented by the Marquis;" and though later researches have shown that this is somewhat unmerited praise, it is evident that he entertained views of the applicability of steam as a moving power, such as no other individual of the age in which he lived had the sagacity to embrace.

The "book" which he promises, at the conclusion of the Century, to leave to posterity, showing "the means to put in execution and visible trial all and every of these inventions, with the shape and form of all things belonging to them,—printed by brass plates," he did not live to execute. The drawing which we have given

\* Walpole.

at the head of this article, as the Marquis's plan of a steam-engine, is an ideal sketch, designed by Professor Millington, from the account of the Century of Inventions (No. 68,) with a slight alteration proposed by Mr. Stuart, in his Descriptive History of the Steam Engine—namely, that of substituting one pipe in the centre, for a pipe placed at each extremity, as in the Professor's arrangement. A more particular description of the Plate we reserve for our next number.

#### TO THE KING'S MOST EXCELLENT MAJESTY.

SIR,—"*Scire meum nihil est, nisi me scire hoc sciat alter*," saith the poet, and I must justly, in order to your Majesty, whose satisfaction is my happiness, and whom to serve is my only aim, placing therein my *summum bonum* in this world: be, therefore, pleased to cast your gracious eye over this summary collection, and then to pick and choose. I confess I made it but for the superficial satisfaction of a friend's curiosity, according as it is set down; and if it might now serve to give aim to your Majesty how to make use of my poor endeavours, it would crown my thoughts, who am neither covetous nor ambitious but of deserving your Majesty's favour, upon my own cost and charges; yet, according to the old English proverb, "It is a poor dog not worth whistling after." Let but your Majesty approve, and I will effectually perform to the height of my understanding: vouchsafe but to command, and with my life and fortune I shall cheerfully obey, and, *maugre* envy, ignorance, and malice, ever appear your Majesty's passionately devoted, or, otherwise, disinterested subject and servant,

WORCESTER.

#### TO THE RIGHT HONOURABLE THE LORDS SPIRITUAL AND TEMPORAL, AND TO THE KNIGHTS, CITIZENS, AND BURGESSES OF THE HONOURABLE HOUSE OF COMMONS, NOW ASSEMBLED IN PARLIAMENT.

*My Lords and Gentlemen,*

Be not startled if I address to all, and every of you, this century of summary heads of wonderful things, even after the dedication of them to his most excellent Majesty, since it is with his most gracious and particular consent, as well as indeed no ways derogating from my duty to his sacred self, but rather in further order unto it, since your Lordships, who are his great council, and you, Gentlemen, his whole kingdom's representatives (most worthily welcome unto him,) may fitly receive into your wise and serious considerations what doth or may publicly concern both his Majesty and his tenderly beloved people.

Pardon me if I say (my Lords and Gentlemen) that it is jointly your parts to digest, to his hand, these ensuing particulars, fitting them to his palate, and ordering how to re-

duce them into practice in a way useful and beneficial both to his Majesty and his Kingdom.

Neither do I esteem it less proper for me to present them to you, in order to his Majesty's service, than it is to give into the hands of a faithful and provident steward whatsoever dainties and provisions are intended for the master's diet; the knowing and faithful steward being best able to make use thereof to his master's contentment and greatest profit, keeping for the morrow whatever should be overplus or needless for the present day, or, at least, to save something else in lieu thereof. In a word (my Lords and Gentlemen,) I humbly conceive this simile not improper, since you are his Majesty's provident stewards, into whose hands I commit myself with all properties fit to obey you, that is to say, with a heart harbouring no ambition, but an endless aim to serve my King and country; and if my endeavours prove effectual (as I am confident they will,) his Majesty shall not only become rich, but his people likewise as treasures unto him; and his peerless Majesty, our King, shall become both beloved at home and feared abroad, deeming the riches of a King to consist in the plenty enjoyed by his people.

And the way to render him to be feared abroad is, to content his people at home, who then, with heart and hand, are ready to assist him; and whatsoever God blesteth me with to contribute towards the increase of his revenues in any considerable way, I desire it may be employed to the use of his people; that is, for the taking off such taxes or burthens from them as they chiefly groan under, and by a temporary necessity only imposed upon them, which, being thus supplied, will certainly best content the King and satisfy his people, which, I dare say, is the continual end of all your indefatigable pains, and the perfect demonstration of your zeal to his Majesty, and an evidence that the Kingdom's trust is justly and deservedly reposed in you. And if ever Parliament acquitted themselves thereof, it is this of yours, composed of most deserving and qualified persons—qualified, I say, with affection to your Prince, and with a tenderness to his people; with a bountiful heart towards him, yet a frugality in their behalf.

Go on, therefore, cheerfully (my Lords and Gentlemen,) and not only our gracious King, but the King of Kings, will reward you; the prayers of the people will attend you; and his Majesty will, with thankful arms, embrace you. And be pleased to make use of me and my endeavours to enrich them, not myself. Such being my only request unto you, spare me not in what your wisdoms shall find me useful, who do esteem myself, not only by the act of the water-commanding engine (which so cheerfully you have past,) sufficiently rewarded, but likewise with courage enabled me to do ten times more for the future; and my debts being paid, and a competency to live according to my birth and quietly settled, the rest shall I dedicate to the service of our King and country by your disposals; and esteem me not the more, or, rather, any more by what is past, but what is to come; professing real-

ly, from my heart, that my intentions are to outgo the six or seven hundred thousand pounds already sacrificed, if countenanced and encouraged by you, ingenuously confessing that the melancholy which hath lately seized me (the cause whereof none of you but may easily guess) hath, I dare say, retarded more advantages to the public service than modesty will permit me to utter; and now, revived by your promising favours, I shall infallibly be enabled thereunto in the experiments extant and comprised under these heads, practicable with my directions by the unparalleled workman, both for trust and skill, Caspar Kaltoff's hand, who has been these five-and-thirty years as in a school, under me employed, and still at my disposal, in a place by my great expenses made fit for public service, yet lately like to be taken from me, and consequently from the service of King and kingdom, without the least regard of about ten thousand pounds expended by me, and through my zeal, to the common good; my zeal, I say, a field large enough for you (my Lords and Gentlemen) to work upon.

The treasures buried under these heads, both for war, peace, and pleasure, being inexhaustible, I beseech you pardon me if I say so. It seems a vanity, but it comprehends a truth, since no good spring but becomes the more plentiful by how much more it is drawn, and the spinner to weave his web is never stinted but further enforced.

The more than that you shall be pleased to make use of my inventions, the more inventive shall you ever find me; one invention begetting still another, and more and more improving my ability to serve my King and you; and as to my heartiness therein, there needs no addition, nor to my readiness a spur. And therefore (my Lords and Gentlemen) be pleased to begin, and desist not from commanding me till I flag in my obedience and endeavours to serve my king and country:

For certainly you'll find me breathless first t'expire,

Before my hands grow weary, or my legs do tire.

Yet, abstracting from any interest of my own, but as a fellow-subject and compatriot, will I even labour in the vineyard, most heartily and readily obeying the least summons from you, by putting faithfully in execution what your judgments shall think fit to pitch upon amongst this century of experiments, perhaps dearly purchased by me, but now frankly and *gratis* offered to you. Since my heart (methinks) cannot be satisfied in serving my King and country, if it should cost them any thing, as I confess, when I had the honour to be near so obliging a master as his late Majesty, of happy memory, who never refused me his ear to any reasonable motion; and as for unreasonable ones, or such as were not fitting for him to grant, I would rather have to dyed a thousand deaths than ever to have made one unto him.

Yet whatever I was so happy as to obtain for any deserving person, my pains, breath, and interest, employed therein, satisfied me



not, unless I likewise satisfied the fees: but that was in my golden age. And even now, though my ability and means are shortened (the world knows why,) my heart remains still the same; and be you pleased, (my Lords and Gentlemen) to rest most assured, that the very complacency that I shall take in the executing your commands shall be unto me a sufficient and abundantly satisfactory reward.

Vouchsafe, therefore, to dispose freely of me, and whatever lieth in my power to perform—first, in order to his Majesty's service; secondly, for the good and advantage of the kingdom; thirdly, to all your satisfactions, for particular profit and pleasure to your individual selves: professing that, in all and each of the three respects, I will ever demean myself as it best becomes,

My Lords and Gentlemen,

Your most passionately bent fellow-subject in his Majesty's service, compatriot for the public good and advantage, and a most humble servant to all and every of you,  
WORCESTER.

#### A CENTURY OF THE NAMES AND SCANTLINGS OF INVENTIONS BY ME ALREADY PRACTISED.

1. Several sorts of seals, some shewing by screws, others by gages fastening or unfastening all the marks at once, others by additional points and imaginary places, proportionable to ordinary escocheons and seals to arms, each way palpably and punctually setting down (yet private from all others but the owner and by his assent) the day of the month, the day of the week, the month of the year, the year of our Lord, the names of the witnesses, and the individual place where any thing was sealed, though in ten thousand several places, together with the very number of lines contained in a contract, whereby falsification may be discovered and manifestly proved, being upon good grounds suspected.

Upon any of these seals a man may keep accounts of receipts and disbursements, from one farthing to an hundred millions, punctually shewing each pound, shilling, penny, or farthing.

By these seals, likewise, any letter, though written but in English, may be read and understood in eight several languages, and in English itself to clean contrary and different sense, unknown to any but the correspondent, and not to be read or understood by him neither, if opened before it arrives unto him: so that neither threats nor hopes of reward can make him reveal the secret, the letter having been intercepted and first opened by the enemy.

2. How ten thousand persons may use those seals to all and every of the purposes aforesaid, and keep their secrets from any but whom they please.

3. A cypher and character so contrived that one line, without returns and circumflexes, stands for each and every of the 24 letters, and as ready to be made for the one letter as the other.

4. This invention refined, and so abbreviated that a point only sheweth distinctly and

significantly any of the 24 letters, and these very points to be made with two pens; so that no time will be lost, but as one finger riseth, the other may make the following letter, never clogging the memory with several figures for words and combinations of letters, which with ease, and void of confusion, are thus speedily and punctually, letter for letter, set down by naked and not multiplied points. And nothing can be less than a point, the mathematical definition of it being, *cujus pars nulla*. And of a motion no swifter imaginable than semiquavers or releshes, yet applicable to this manner of writing.

5. A way, by circular motion, either along a rule or ringwise, to vary any alphabet, even this of points, so that the self-same point, individually placed without the least additional mark or variation of place, shall stand for all the 24 letters, and not for the same letter twice in ten sheets writing, yet as easily and certainly read and known as if it stood but for one and the self-same letter constantly signified.

6. How at a window, as far as eye can discover black from white, a man may hold discourse with his correspondent, without noise made or notice taken; being, according to the occasion given and means afforded, *ex re nata*, and no need of provision beforehand, though much better if foreseen, and means prepared for it, and a premeditated course taken by mutual consent of parties.

7. A way to do it by night as well as by day, though as dark as pitch is black.

8. A way how to level and shoot cannon by night as well as by day, and as directly, without a platform or measures taken by day, yet by a plain and infallible rule.

9. An engine portable in one's pocket, which may be carried and fastened on the inside of the greatest ship, *tanquam avis agens*, and, at any appointed minute, though a week after, either of day or night, it shall irrecoverably sink that ship.

10. A way, from a mile off, to drive and fasten a like engine to any ship, so as it may punctually work the same effect either for time or execution.

11. How to prevent and safeguard any ship from such an attempt by day or night.

12. A way to make a ship not possible to be sunk, though shot an hundred times betwixt wind and water by cannon, and should lose a whole plank, yet, in half an hour's time, should be made as fit to sail as before.

13. How to make such false decks as, in a moment, should kill and take prisoners as many as should board the ship, without blowing the decks up, or destroying them, from being reducible, and in a quarter of an hour's time should recover their former shape, and to be made fit for any employment, without discovering the secret.

14. How to bring a force to weigh up an anchor, or to do any forcible exploit, in the narrowest or lowest room in any ship, where few hands shall do the work of many; and many hands applicable to the same force, some standing, others sitting, and, by virtue of their several helps, a great force, augmented in little room, as effectual as if there

were sufficient space to go about with an axletree, and work far from the centre.

15. A way to make a boat work itself against wind and tide, yea, both without the help of man or beast; yet so that the wind or tide, though directly opposite, shall force the ship or boat against itself, and in no point of the compass, but it shall be as effectual as if the wind were in the *pupp*, or the stream actually with the course it is to steer, according to which the oars shall row, and necessary motions work and move, towards the desired port or point of the compass.

16. How to make a sea-castle, or fortification, cannon proof, and capable of containing a thousand men, yet sailable at pleasure to defend a passage; or, in an hour's time, to divide itself into three ships, as fit and trimmed to sail as before; and even whilst it is a fort or castle they shall be unanimously steered, and effectually be driven, by an indifferent strong wind.

17. How to make upon the Thames a floating garden of pleasure, with trees, flowers, banqueting-houses, and fountains, stews for all kinds of fishes, a reserve for snow to keep wine in, delicate bathing-places, and the like; with music made with (2) mills, and all in the midst of the stream, where it is most rapid.

18. An artificial fountain, to be turned, like an hour-glass, by a child in the twinkling of an eye; it holding a great quantity of water, and of force sufficient to make snow, ice, and thunder, with a chirping and singing of birds, and showing of several shapes and effects usual to fountains of pleasure.

19. A little engine within a coach, whereby a child may stop it, and secure all persons within it, and the coachman himself, though the horses be never so unruly in a full career; a child being sufficiently capable to loosen them in what posture soever they should have put themselves, turning never so short, for a child can do it in the twinkling of an eye.

20. How to bring up water balancewise, so that as little weight or force as will turn a balance will be only needful, more than the weight of the water within the buckets, which, counterpoised, empty (3) themselves one into the other, the uppermost yielding its water (how great a quantity soever it holds) at the selfsame time the lowermost taketh it in, though it be a hundred fathom high.

21. How to raise water constantly with two buckets only, day and night, without any other force than its own motion, using not so much as any force, wheel or sucker, nor more pulleys than one, on which the cord or chain rolleth, with a bucket fastened at each end. This, I confess, I have seen and learned of the great mathematician Claudius (4) his Studies at Rome, he having made a present thereof unto the Cardinal; and I desire not to own any other men's inventions, but if I set down any, to nominate likewise the inventor.

22 To make a river in a garden to ebb and flow constantly, though twenty feet over,

with a child's force in some private room, or place out of sight, and a competent distance from it.

23. To set a clock in (5) a castle, the water filling the trenches about it; it shall shew, by ebbing and flowing, the hours, minutes, and seconds, and all the comprehensible motions of the heavens, and counterlibration of the earth, according to Copernicus.

24. How to increase the strength of a spring to such an height as to shoot bombasses and bullets of an hundred pound weight a steeple height, and a quarter of a mile off, and more, stone-bowwise; admirable for fire-works, and astonishing of besieged cities, when, without warning given by noise, they find themselves so forcibly and dangerously surprised.

25. How to make a weight that cannot take up an hundred pound, and yet shall take up two hundred pound, and at the selfsame distance from the centre; and so, proportionably, to millions of pounds.

26. To raise weight as well and as forcibly with the drawing back of the lever, as with the thrusting it forwards; and, by that means, to lose no time in motion or strength. This I saw in the arsenal at Venice.

27. A way to move to and fro huge weights, with a most inconsiderable strength, from place to place. For example, ten ton with ten pounds, and less; the said ten pounds not to fall lower than it makes the ten ton to advance or retreat upon a level.

28. A bridge, portable in (6) a cart with six horses, which in a few hours time may be placed over a river half a mile broad, whereon with much expedition may be transported horse, foot, and cannon.

29. A portable fortification, able to contain five hundred fighting men; and yet, in six hours time, may be set up and made cannon-proof, upon the side of a river or pass, with cannon mounted upon it, and as complete as a regular fortification, with half-moons and counterscarps.

30. A way, in one night's time, to raise a bulwark twenty or thirty foot high, cannon-proof, and cannon mounted upon it, with men to overlook, command, and batter a town; for though it contain but four pieces, they shall be able to discharge two hundred bullets each hour.

31. A way how, safely and speedily, to make an approach to a castle or town wall, and over the very ditch, at noon day.

32. How to compose an universal character, methodical and easy to be written, yet intelligible in any language; so that if an Englishman write it in English, a Frenchman, Italian, Spaniard, Irish, Welch, being scholars, yea, Grecian or Hebrean, shall as perfectly understand it in their own tongue as if they were perfect English, distinguishing the verbs from nouns, the numbers, tenses, and cases, as properly expressed in their own language as it was written in English.

33. To write with a needle and thread, white, or any colour, upon white, or any other colour, so that one stitch shall significantly shew any letter, and as readily and

(2) "By," MS. copy.

(3) "Counterpoised and empty."

(4) "Clavius."

(5) "As within."

(6) "Upon."



as easily shew the one letter as the other, and fit for any language.

34. To write by a knotted silk string, so that every knot shall signify any letter, with comma, full point, or interrogation, and as legible as with pen and ink upon white paper.

35. The like, by the fringe of gloves.

36. By stringing of bracelets.

37. By pink'd gloves.

38. By holes in the bottom of a sieve.

39. By a lattin, or plate lanthorn (7.)

40. By the smell.

41. By the taste.

42. By the touch.

Note—By these three senses, as perfectly, distinctly, and unconfusedly, yea, as readily as by the sight.

43. How to vary each of these, so that ten thousand may know them, and yet keep the understanding part from any but their correspondent.

44. To make a key of a chamber-door, which to your sight hath its wards and rose-pipe but paper thick, and yet at pleasure, in a minute of an hour, shall become a perfect pistol, capable to shoot through a breast-plate commonly of carabine proof, with prime, powder, and firelock, and is coverable in a stranger's hand.

45. How to light a fire and candle at what hour of the night one waketh, without rising or putting one's hand out of the bed. And the same thing becomes (8) a serviceable pistol at pleasure; yet by a stranger, not knowing the secret seemeth but a dexterous tinder-box.

46. How to make an artificial bird to fly which way and as long as one pleaseth, by or against the wind, sometimes chirping, other times hovering, still tending the way it is designed for.

47. To make a ball of any metal, which, thrown into a pool or pail of water, shall presently rise from the bottom, and constantly show, by the superficies of the water, the hour of the day or night, never rising more out of the water than just to the minute it showeth of each quarter of the hour; and if by force kept under water, yet the time is not lost, but recovered as soon as it is permitted to rise to the superficies of the water.

48. A screwed ascent, instead of stairs, with fit landing-places to the best chambers of each story, with back stairs within the noell of it, convenient for servants to pass up and down to the inward rooms of them, unseen and private.

49. A portable engine, in the way of a tobacco-tongs, whereby a man may get over a wall, or get up again, being come down, finding the coast proving unsecure to him.

50. A complete light portable ladder, which, taken out of one's pocket, may be by himself fastened an hundred feet high, to get up by from the ground.

51. A rule of gradation, which with ease and method reduceth all things to a private correspondence, most useful for secret intelligence.

52. How to signify words, and a perfect discourse, by jangling of bells of any parish church, or by any musical instrument within hearing, in a seeming way of tuning it, or of an unskilful beginner.

53. A way how to make hollow and cover a water-screw, as big and as long as one pleaseth, in an easy and cheap way.

54. How to make a water-screw tight, and yet transparent and free from breaking, but so clear that one may palpably see the water, or any heavy thing, how and why it is mounted by turning.

55. A double water-screw, the innermost to mount the water, and the outermost for it to descend more in number of threads, and consequently, in quantity of water, though much shorter than the innermost screw, by which the water ascendeth—a most extraordinary help for the turning of the screw to make the water rise.

56. To provide and make, that all the weights of the descending side of a wheel shall be perpetually further from the centre than those of the mounting side, and yet equal in number and heft to (9) the one side as the other. A most incredible thing, if not seen, but tried before the late king (of blessed memory) (10) in the Tower, by my directions, two extraordinary Embassadors accompanying his Majesty, and the Duke of Richmond and Duke Hamilton, with most of the Court attending him. The wheel was 14 feet over, and 40 weights, of 50 pounds apiece. Sir William Balfore, (11) then Lieutenant of the Tower, can justify it, with several others. They all saw, that no sooner the great weights passed the diameter line of the lower (12) side, but they hung a foot further from the centre; nor no sooner passed the diameter line of the upper side, but they hung a foot nearer. Be pleased to (13) judge the consequence.

57. An ebbing and flowing water-work, in two vessels, into either of which, the water standing at a level, if a globe be cast in, instead of rising, it presently ebbeth, and so remaineth until a like globe be cast into the other vessel, which the water is no sooner sensible of, but that (14) vessel presently ebbeth and the other floweth, and so continueth ebbing and flowing until one or both of the globes be taken out, working some little effect besides its own motion, without the help of any man within sight of hearing: but if either of the globes be taken out, with ever so swift or easy a motion, at the very instant the ebbing and flowing ceaseth; for if, during the ebbing, you take out the globe, the water of that vessel presently returneth to flow, and never ebbeth after until the globe be returned into it, and then the motion beginneth as before.

58. How to make a pistol discharge a dozen times with one loading, and without so much as once new priming requisite, or to

(7) "Candlestick lantern."

(8) "To be."

(9) "Of."

(10) "Of happy and glorious," &c.

(11) "Sir W. Belford."

(12) "Upper."

(13) "Lower."

(14) "The."

change it out of one hand into the other, or to stop one's horse.

59. Another way, as fast and effectual, but more proper for carrabines.

60. A way, with a flask appropriated unto it, which will furnish either pistol or carrabine with a dozen charges in three minutes' time, to do the whole execution of a dozen shots, as soon as one pleaseth, proportionably.

61. A third way, and particular for musquets, without taking them from their rests to charge or prime, to a like execution, and as fast as the flask, the musquet containing but one charge at a time.

62. A way for a harquebuss, a crock, or ship musket, six upon a carriage, shooting with such expedition, as, without danger, one may charge, level, and discharge them, sixty times in a minute of an hour, two or three together.

63. A sixth way, most excellent for sakers, differing from the other, yet as swift.

64. A seventh, tried and approved before the late King (of ever blessed memory,) and a hundred Lords and commons, in a cannon of eight inches half quarter, to shoot bullets of 64 pounds weight, and 24 pounds of powder, twenty times in six minutes; so clear from danger, that, after all were discharged, a pound of butter did not melt, being laid upon the cannon britch, nor the green oil discoloured that was first anointed and used between the barrel thereof, and the engine having never in it, nor within six foot of it, but one charge at a time.

65. A way that one man in the cabin, may govern the whole side of ship musquets, to the number (if need require) of 2 or 3000 shots.

66. A way that, against several avenues to a fort or castle, one man may charge 50 cannons playing, and stopping when he pleaseth, though out of sight of the cannon.

67. A rare way, likewise, for musquetoons fastened to the pummel of the saddle, so that a common trooper cannot miss to charge them with twenty or thirty bullets at a time, even in full career.

"When I first gave my thoughts to make guns shoot often, I thought there had been but one only exquisite way inventible, yet, by several trials, and much charge, I have perfectly tried all these."

68. An admirable and most forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be, as the philosopher calleth it, *infra sphaeram activitatis*, which is but at such a distance. But this way hath no bounder, if the vessels be strong enough; for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, (15) stopping screwing up the broken end, as also the touch-hole, and making a constant fire under it, within 24 hours it burst, and made a great crack: so that having a way (16) to make my vessels, so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant foun-

tain-stream, 40 feet high; one vessel of water, rarified by fire, driving up 40 of cold water. And a man that tends the work is but to turn two cocks, that one vessel of water being consumed, another to force and refill with cold water, and so successively, the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the intermin between the necessity of turning the said cocks.

69. A way how a little triangle screwed key, not weighing a shilling, shall be capable (17) and strong enough to bolt and unbolt, round about a great chest, an hundred bolts, through 50 staples, two in each, with a direct contrary motion, and as many more from both sides and ends; and, at the self-same time, shall fasten it to the place, beyond a man's natural strength to take it away; and in one and the same turn, both locketh and openeth it.

70. A key, with a rose-turning pipe, and two roses, pierced through endwise the bit thereof, (18) with several handsomely contrived wards, which may likewise do the same effects.

71. A key perfectly square, with a screw turning within it, and more conceited than any of the rest, and no heavier than the triangle-screwed key, and doth the same effects.

72. An escutcheon to be placed before any of these locks, with these properties:—

1st, The owner (though a woman) may, with her delicate hand, vary the ways of coming to open the lock ten millions of times, beyond the knowledge of the smith that made it, or of me who invented it.

2d, If a stranger open it, it setteth an alarm a going, which the stranger cannot stop from running out; and, besides, though none should be within hearing, yet it catcheth his hand, as a trap doth a fox; and though far from maiming him, yet it leaveth such a mark behind it, as will discover him if suspected; the escutcheon, or lock, plainly showing what monies he hath taken out of the box to a farthing, and how many times opened since the owner had been at it.

73. A transmittable gallery over any ditch or breach in a town wall, with a blind and parapit cannon proof.

74. A door, whereof the turning of the key, with the help and motion of the handle, makes the hinges to be of either side, and to open either inward or outward, as one is to enter or to go out, or to open in half.

75. How a tape or ribbon-weaver may set down a whole discourse, without knowing a letter, or interweaving any thing suspicious of other secret than a new-fashioned ribbon.

76. How to write in the dark as straight as by day or candle-light.

77. How to make a man to fly, which I have tried with a little boy of ten years old in a barn from one end to the other, on a hay-mow.

78. A watch to go constantly, and yet needs no other winding from the first setting on the cord or chain, unless it be broken, re-

(15) "Full"—merely.

(16) "Found a way."

(17) "Triangle and screwed key shall be capable."

(18) "Together."



quiring no other care from one man than to be now and then consulted with concerning the hour of the day or night; and if it be laid by a week together, it will not err much, but the oftener looked upon the more exact it sheweth the time of day or night.

79. A way to lock all the boxes of a cabinet (though never so many) at one time, which were by particular keys, appropriate to each lock, opened severally and independent the one of the other, as much as concerneth the opening of them, and by these means cannot be left open unawares.

80. How to make a pistol barrel no thicker than a shilling, and yet able to endure a musquet proof of powder and bullet.

81. A combe-conveyance carrying of letters, without suspicion, the head being opened with a needle-screw drawing a spring towards them (19) the combe being made but after an usual form carried in one's pocket.

82. A knife, spoon, or fork, in an usual portable case, may have the like conveyances in their handles.

83. A raspin-mill for hartshorn, whereby a child may do the work of half-a-dozen men, commonly taken up with that work.

84. An instrument, whereby persons ignorant in arithmetic may perfectly observe numerations and subtractions of all sums and fractions.

85. A little ball made in the shape of a plum or pear, being (20) dexterously conveyed or forced into a body's mouth, shall presently shoot forth such and so many bolts of each side and at both ends, as without the owner's key, can neither be opened or filed off, being made of tempered steel, and as effectually locked as an iron chest.

86. A chair, made *a-la-mode*, and yet a stranger being persuaded to sit down in't, shall have immediately his arms and thighs locked up beyond his own power to loosen them.

87. A brass mould, to cast candles in which a man may make 500 dozen in a day, and add an ingredient to the tallow, which will make it cheaper, and yet so that candles shall look whiter and last longer.

88. (21) How to make a brazen or stone head, in the midst of a great field or garden, so artificial and natural, that though a man speak ever so softly, and even whispers into the ear thereof, it will presently open its mouth, and resolve the question in French, Latin, Welch, Irish, or English, in good terms uttering out of its mouth, and then shut it until the next question be asked.

89. White silk, knotted in the fingers of a pair of white gloves, and so contrived, without suspicion, that playing at primero, at cards, one may, without clogging his memory, keep reckoning of all sixes, sevens, and aces, which he hath discarded. (22.)

90. A most dexterous dicing-box, with holes transparent, after the usual fashion, with a device so dexterous, that, with a knock of it against the table, the four good

dice are fastened, and it looseth four false dice made fit for the purpose.

91. An artificial horse with saddle and caparisons fit for running at the ring, on which a man being mounted, with his lance in his hand, he can at pleasure make him start, and swiftly run his career, using the decent posture with *bon grace*, may take the ring as handsomely, and running as swiftly, as if he rode upon a barbe.

92. A screw, made like a water-screw, but the bottom made of iron plate, spade-wise, which, at the side of a boat, emptieth the mud of a pond, or raiseth gravel.

93. An engine, whereby one man may take out of the water a ship of 500 ton, so that it may be calked, trimmed, and repaired, without need of the usual way of stocks, and as easily let it down again.

94. A little engine, portable in one's pocket, which, placed to any door, without any noise but one crack, openeth any door or gate.

95. A double cross-bow, neat, handsome, and strong, to shoot two arrows, either together, or one after the other, so immediately, that a deer cannot run two steps, but, if he miss of one arrow, he may be reached with the other, whether the deer run forward, sideward, or start backward.

96. A way to make a sea-bank so firm and geometrically strong, so that a stream can have no power over it; excellent, likewise, to save the pillar of a bridge, being cheaper and stronger than stone walls.

97. An instrument whereby an ignorant person may take any thing in perspective as justly, and more, than the skillfullest painter can do by his eye.

98. An engine, so contrived, that working the *primum mobile* forward or backward, upward or downward, circularly or cornerwise, to and fro, streight, upright, or downright, yet the pretended operation continueth, and advanceth none of the motions above-mentioned, hindering, much less stopping, the other; but unanimously and with harmony agreeing, they all augment and contribute strength unto the intended work and operation; and, therefore, I call this a *semi-omnipotent engine*, and do intend that a model thereof be buried with me.

99. How to make one pound weight to raise an hundred as high as one pound fall-eth, and yet the hundred pound descending doth what nothing less than one hundred pound can effect.

100. Upon so potent a help as these two last mentioned inventions, a water-work is, by many years experience and labour, so advantageously by me contrived, that a child's force bringeth up, an hundred foot high, an incredible quantity of water, even two foot diameter, so naturally, that the work will not be heard, even into the next room; and with so great ease and geometrical symmetry, that though it work day and night, from one end of the year to the other, it will not require forty shillings reparation to the whole engine, nor hinder one's day-work; (23) and I may boldly call it the most stupendous work in

(19) "One."

(20) "Which being."

(21) "An engine without ye least noyse, knock, or use of fyre, to coyne and stamp 100lb in an houre by one man."

(22) "Without foul play."

(23.) The words marked in Italics not in the M. S.

the whole world ; not only, with little charge, to drain all sorts of mines, and furnish cities with water, though never so high seated, as well as keep them sweet, running through several streets, and so performing the work of scavengers, as well as furnishing the inhabitants with sufficient water for their private occasions ; but likewise supplying rivers with sufficient to maintain and make them portable from town to town, and for the bettering of lands all the way it runs ; with many more advantageous and yet greater effects of profit admirable and consequence. So that deservedly I deem this invention to crown my labours, to reward my expenses, and make my thoughts acquiesce in way of further inventions ; this making up the whole century, and preventing any further trouble to the reader for the present, meaning to leave to posterity a book, wherein, under each of these heads, the means to put in execution, and visible trial, all and every of these inventions, with the shape and form of all things belonging to them, shall be printed by brass plates.

*In bonum publicum, et ad majorem Dei gloriam.* (24.)

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(25.) "Index."

(26.) A mute yet perfect discourse, as far distant as eye can reach by day to discern colours."

(27.) "Though never soe darke."

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(30.) For weights—wanting in the MS.

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(31.) And each of these—wanting.

(32.) Forsakes.

(33.) "For whole cannon."

(34.) A whole side of—wanting.

(35.) Or ribbon—wanting.

(36.) "A continual watch."

(37.) A total—wanting.

(38.) "81. 82. Conveyance for letters."

(39.) Wanting entirely in the M. S.



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## HIGH PRESSURE STEAM-ENGINES.

The following documents will be found of considerable importance, in relation to a question which has been much agitated in this country, as well as in America, namely, whether High Pressure Engines can be employed with safety in steam navigation?

## REPORT

*Of the Committee on Commerce (of the Congress of the United States,) accompanied by a Bill for regulating of Steam Boats, and for the Security of Passengers therein.—May 22, 1824.*

The Committee of Commerce, to which was referred a resolution instructing them to inquire into the expediency of providing by law, that no license to navigate any of the waters of the United States shall be granted to any boat or vessel, hereafter built, and moved or propelled by fire or steam, upon the principle of construction commonly called "high pressure;" nor to any boat or vessel heretofore built, and moved or propelled by fire or steam, that shall hereafter be fitted up or provided with any engine or other machine, intended to move or propel such boat or vessel, upon the principle of construction aforesaid, respectively Report:

That they entered upon the investigation of this subject with a deep sense of its importance, and a strong conviction of the great difficulties attending any legislative interference with the management of so extensive a branch of business.

The power of steam to propel boats, which was first successfully applied to practical purposes in the United States, is now in extensive and general use on all the waters of the Union; its application on the great rivers of the Mississippi and Ohio, has contributed in an eminent degree to the prosperity and advancement of the States through which they flow.

To what farther application the agency of steam is capable, and to what extent it may be carried by the science and ingenuity of our mechanicians, cannot be anticipated; and your Committee felt averse to fetter or

discourage the ingenuity and skill for which the artists of this country are so distinguished; nothing, therefore, but a consideration of what is due to the protection of individuals, whose safety may be endangered by ignorance, avarice, or inattention, from which they have not the power to protect themselves, induces your Committee to recommend the interposition of Congress.

Your Committee believe it to be the universal opinion of all persons conversant in such subjects, that steam-engines, of a certain construction, may be applied to passage-boats with the most perfect security to the passengers.

The low pressure engine (commonly known as the engine of Bolton and Watt) consists, besides the boiler and cylinder, of an air-pump and condenser; on opening the communication with the condenser, the steam on one side of the piston, in the cylinder, is condensed by this process, the water in the condenser becomes heated, and is drawn off by the air-pump, and its place supplied by cold water, which again condenses the steam now collected on the other side of the piston. The size of the air-pump is calculated to free the condenser of a certain quantity of water only, in proportion to the size of the cylinder; and as this quantity of water, at the usual temperature, can only condense a specific quantity of steam, if the steam from the boiler is furnished of an extremely high temperature, the vacuum of the cylinder will not be perfect, and, consequently, the engine will not materially gain in power by increasing the force of the steam, the additional pressure being not more than equal to the loss from an imperfect vacuum. The condensing engine, therefore, when constructed on proper principles, merely requires a pressure of steam equal to that of the atmosphere, in order to drive out the atmospheric air, and to supply its place with steam, which, being condensed, forms the vacuum, giving a pressure of about 14 lbs. on the square inch. It will readily be perceived, therefore, that with low pressure engines, there is little inducement to increase the pressure of steam in the boiler; and as the utmost that can be produced by the common boiler of Bolton and Watt's engine does not exceed 15 or 18 lbs. on the square inch, there is less danger of bursting them, and the damage arising from such an accident is seldom more than rending the boiler, and scalding those in its immediate vicinity, without doing any injury to the boat or passengers in the cabin. The high pressure engines are driven entirely by the force of the steam, without any assistance from a vacuum, and are usually calculated for a pressure of from 40 to 100 lbs. to the square inch, on which the power of the engine is calculated; but, in case of emergency, the force may be multiplied to any extent to which the temperature of steam may be raised; so that an engine of 20 horse power may be made to perform the work of a 40, or even of 100 horse power. This effect, however, is produced at the risk of bursting the boiler, and endangering the lives of the passengers.

From habitual impunity, the engine-workers disregard the danger, and rather than

(40.) "Stamping engine."

(41.) "Primero gloves." The Marques seems to have been in doubt which he should erase—the brazen head or the dicing-box.

(42.) Wanting in the M. S.

suffer a boat to pass them, will increase the pressure of the steam to a dangerous extent. In addition to this risk, accidents may occur from carelessness, inattention, or drunkenness.

On land, the high pressure engine is not subject to the same objection. The power of the steam, in the first instance, is calculated for the work to be done in the mills, and the inducement to augment it is not very great.

Many respectable mechanics and engineers in this country for some time considered that the improved boiler, invented by Oliver Evans, obviated the objections to high pressure engines. The late melancholy occurrence on board the *Etna*, in the waters of New-York harbour, must have undeceived them. The engine in this boat was constructed on the plan of that skilful mechanic, and was furnished with all the guards his ingenuity could devise.

Your Committee, from this view of the subject, are decidedly of opinion, that high pressure engines, under any guard that could be applied to them, are not as safe to use in boats as those of low pressure. But, as a vast amount of property is vested in boats propelled by high pressure steam-engines, especially on the Mississippi and Ohio rivers, they forbear to recommend the adoption of any measure which would go to prohibit their use. In boats loaded differently, at different times, and navigating streams where the current is often of unequal velocity, it may be advantageous to use an engine capable of receiving an additional power. In order, however, to give them all the security of which they are susceptible, they recommend that all boats propelled by steam should be enrolled at the port nearest to the place from or to which they proceed, and should be compelled to take out a coasting license.

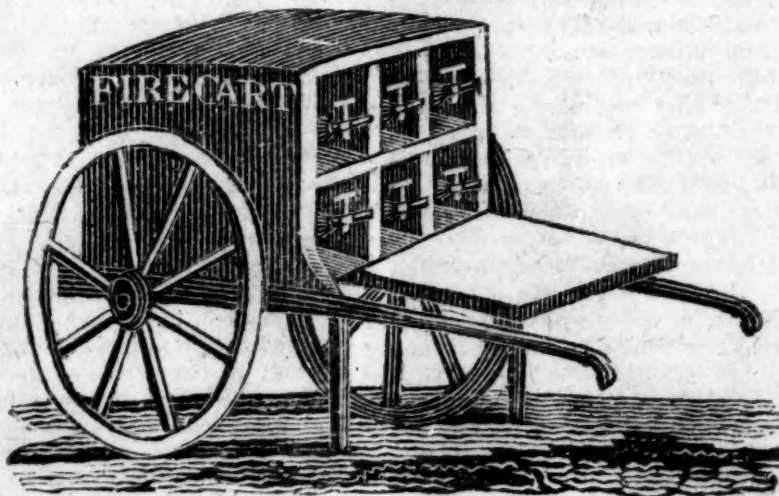
That every boiler on board such steamboats should be composed of wrought iron or copper. The strength of a cast iron boiler is uncertain. Cast iron being liable to contract in various degrees, in different places, and is, therefore, more liable to break than wrought iron; and in the event of bursting, the fragments are scattered about with great force, whereas in the bursting of a boiler of malleable metal, a simple rending generally takes place, unless under a pressure of steam exceeding 2 or 300lbs. to the square inch.

That every boiler on board such boat should, previous to the boat being used for the conveyance of passengers, be submitted to the inspection of one or more skilful engineers, or other persons conversant with the subject, who should ascertain, by trial, the strength of such boiler, and should certify his opinion of its sufficient strength, and of the security with which it might be employed, to the extent proposed. That every such boiler should be provided with two sufficient safety valves, one of which should be inaccessible to the engine-worker, and the other accessible to him and the persons on board the boat. The inspectors to examine the safety valves, and certify what is the pressure at which such safety valves shall open, which pressure shall not exceed one-third of that by which the boiler has been proved, nor one-sixth of that which, by calculation, it shall be reckoned able to sustain in high pressure steam-engines; nor one-half the pressure by which the boiler has been proved, nor one-third of what, by calculation, it shall be reckoned able to sustain, if a low pressure engine. That a penalty shall be inflicted on any person placing additional weight on either of the safety valves.

*(To be continued.)*

## PLAN FOR THE SPEEDY EXTINCTION OF FIRES;

BY CAPTAIN MANBY.



It must be obvious that the ready extinction of fire depends entirely on the facility with which water is brought to act upon it at its commencement; and that, when left uncontrolled during the delay of engines arriving, the procurement of



water, and the farther delay of getting the engines into full action, it reaches a height at which its reduction is highly doubtful, and at least very difficult. Many instances of destruction by fire have been caused by obstructions to the conveyance of engines to the spot, or from the impossibility of procuring water to enable them to act when they have arrived; and, in every case, some delay necessarily takes place in preparing the engines, even when water is at hand. It is a well-known fact, that many of the great and destructive fires in London and other large towns, where water-pipes are laid, might have been controlled, if water could have been obtained in time. In towns not so provided, villages, the detached residences of gentlemen, and other buildings in the country, the want of water at hand, or other means of extinction, makes their total destruction, in case of fire, almost inevitable.

From observations which I have made in witnessing fires, and from information of those persons constantly employed on such occasions, I am assured that a small quantity of water, well directed and early applied, will accomplish what, probably, no quantity would affect at a later period. This has excited my attempts to provide

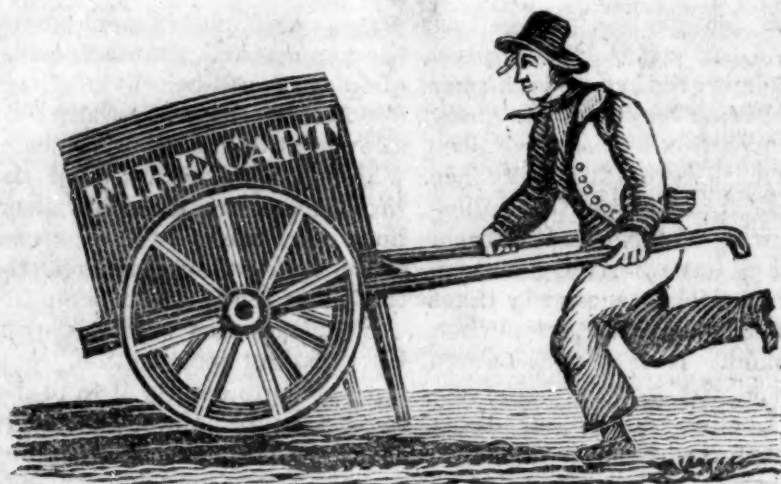
some prompt and efficient means by which the anxious and often important interval of delay would be obviated, and the fire opposed on the first alarm; thereby not allowing the flames to increase in fury; which so often occurs, that the efforts of the fireman are exerted rather with the hope of preventing the extension of the calamity to other buildings, than to save that in which it first broke out.

To attain this object, I propose a Fire Cart of light construction, requiring but one person to convey it to the spot, and apply a fluid, in the most efficacious manner, from portable vessels or engines, on a principle very long known—the artificial fountain in pneumatics. The engines are to be always charged, and one, when slung across the body of a watchman or servant, is easily carried to any part of the building, however difficult of access. The management required is simple; for, on opening the stop-cock, the pressure of condensed air instantly propels a stream that can be directed with the most exact precision on the part in combustion,—a circumstance extremely important, when the incipient fire is not within the reach of effort by the hand, and when the air, heated by the flames, prevents approach to cast water upon it by common means.



Every fire, even the greatest, must arise from small beginnings, and when discovered in its infant and commencing state, is easily to be kept down and prevented from becoming destructive, if means of early application were at hand. We often hear

of the alarm of fire given by watchmen long before the arrival of engines on the spot; and, if they were provided with a fire cart, the alarm of the watch and the application of the means of extinction would be simultaneous.



The cart contains six engines each, charged with the impregnated solution of an ingredient best adapted to extinguish fire. When the first engine has expended its store of antiphlogistic fluid, a supply of others in succession may keep up a constant discharge, until regular engines and plenty of assistance arrive, should the fire not be entirely subdued by these first efforts.

When a small quantity of simple water is cast on materials in a state of violent combustion, it evaporates into steam from the heat, and the materials thus extinguished readily ignite again; the addition of incombustible ingredients, consequently, becomes necessary to make quality supply the place of quantity, and thus with the smallest portion prevent the fire rekindling.

To give the most extinguishing properties to common water has engaged the experimental attention of many, in different countries,\* and it has been rendered by

\* 1734. M. Fuches, a German physician, by throwing balls into the fire, containing certain preparations, which burst with violence, instantly quenched the fire.

1761. Zachary Grey used the same process, in which were alum, sal ammoniac, and other saline matters, with water.

In the same year Dr. Godfrey, in a public exhibition in a house erected for that purpose near Mary-le-bone, applied the like ingredients with great success, by the action of confined gunpowder only, which, exploding, dispersed the solution on the materials in combustion, and effectively extinguished the same.

1792. M. Van Ahen, at Stockholm, made numerous public experiments to show the effects of several combined ingredients to render materials entirely incombustible; he is stated to have subdued an artificial fire by two men and forty measures of preparation, that would have required twenty men and 1500 of the same measures of simple water.

In the same year, M. Nil. Mosheim made many public exhibitions to confirm that com-

them more effective to extinguish fire than forty times the same quantity of common water (a circumstance not speculative, but confirmed by trial made upon buildings erected for that purpose;) but the simple ingredient of pearl ash dissolved in water, when applied on burning substances, forming an incrustation over the surface extinguished, and thereby preventing the access, has in my estimation, a decided preference; it has likewise the superior recommendation of the readiness with which any person may imbue the water with it, while the compounds cannot be had but at considerable cost, nor be prepared without labour and nice accuracy in their respective proportions. Thus, at the moderate ratio of twenty times increasing the quality, the cart would convey an extinguishing fluid equal to one tun and a half of common water.

*Specification in reference to the Apparatus belonging to the Fire Cart.*

Each machine is a strong copper vessel, of a cylindrical form, two feet in length, and eight inches in diameter, capable of containing four gallons: a tube of the same metal, of one-fourth of an inch in diameter, curved so that its end is carried to the side of the vessel, with a stop-cock and jet-pipe, the vent of which is one-eighth of an inch in diameter at its top, reaches to within half an inch of the bottom, and is to be screwed so closely into the neck of the vessel as to preclude the possibility of the escape of the air.

Three gallons of water, holding in solution any ingredients\* best adapted to extinguish fire, are to be put into the vessel, and then the room remaining for the fourth gallon to be filled with closely condensed air; to effect which, the jet-pipe is to be unscrew-

bustible material might be made perfectly incombustible; as also did Mr. W. Knox, of Gottenburg.

\* Pearl ash, dissolved in water, when applied on burning substances, forms an incrustation over the surface extinguished, and prevents that part from rekindling.



ed, the condensing-syringe fixed in its place, and the air to be pumped in, to the utmost power of the strength of the vessel to contain it; the stop-cock is then to be closed, condensing-syringe taken off, and the jet-pipe replaced.

On turning back the stop-cock, the condensed air re-acts on the water, and casts it to a height proportioned to the degree of condensation.

That the machine may be more easily carried, where access is difficult, it is put into a leathern case with a strap, and slung over the shoulders of the bearer, is thus conveyed easily, and then directed with the utmost precision to the point requiring the water.

As directions for the effective arrangement of fire carts in populous places, the following plan I should propose: That at each watch-house, from the time of the watch setting, there should be in attendance a regular fireman, instructed in the use and management of the apparatus; and that each parish should be provided with one or more fire carts, according to its extent or number of wards, and the vessels or engines composing the complement of the carts to be kept charged ready for being immediately applied. When watch-boxes or stations are at a considerable distance from the watch-house some central watch-box should have a single engine lodged ready for application, to be brought on the alarm by the watchman, and delivered to the fireman, who repairs to the spot on the alarm of fire being given, with as much expedition as possible. Should the fire have broken out near the depôt of the fire cart, the fireman in attendance will take the cart with him, or an engine from it ready to apply; if otherwise, the watchmen will each bring an engine, which the firemen will expend, and by receiving from others their engines, a regularly-continued and well-directed stream will be kept up, which, from the early opposition to the fire, will no doubt check the flames, if not entirely subdue the fire; should the distance be considerable, the fireman, aided by a watchman, would convey the cart to a place on fire with as much despatch as possible.

*Letter from the Hon. Capt. Pellew, R. N. to Captain Manby.*

"London, June 27, 1816.

"MY DEAR SIR,—Having been one of those who witnessed, with much satisfaction, the trial of your newly-invented machine for the extinction of fire in its earliest stages, I cannot refrain from relating to you, that, in the late fire close to my house, and which I myself discovered, if I had had one of the machines at my immediate command, I do not hesitate to say, I could have saved the whole premises and an uninsured property of nearly 12,000l. I can venture to assert this fact, because it came under my own inspection;

I therefore cannot be deceived. The fire, when I first saw it, was just caught, and I conceive was quite extinguishable by your machine for at least twenty minutes.

"I may also here give my opinion as a naval man, as to its great use, in my opinion, on board ships, in case of fire below, where water is not easily conveyed. I shall never go to sea again without one of them for the use of the store-rooms, &c. Upon the whole, I do declare to you, it is, in my opinion, one of the best inventions I ever saw; and wishing you every success in the prosecution of your generous plans,

"I am, Sir, yours, &c.

"P. B. PELLEW."

#### BROWN'S GAS ENGINE.

SIR,—Mr. Brown's contrivance is not new. There is, at present, in Mr. Leslie's Class-room, College of Edinburgh, a machine constructed upon the very same principles; the *primum mobile* being an oil lamp, which rarifies the air, thus forming a kind of vacuum under a piston, from which the power proceeds. *This is an incontrovertible fact, for I have seen the machine in full action.* It moves with prodigious velocity, so long as the cylinder, in which the piston acts, is cool; but as soon as it becomes heated, the process of the machine is greatly retarded.

This is not the first time that ingenious men have been found asserting their contrivances to be new inventions. The late Mr. Bramah went into the same mistake, when he pronounced his hydraulic press to be a new mechanic power. J. Y.

#### CLOCK-MAKING.

SIR,—In perusing your 43th Number of the "Mechanics' Magazine," page 315, I observed some remarks by Mr. James Collins, on Dr. Franklin and Mr. James Ferguson's three wheel clocks, with his own improvement. I perfectly agree with Mr. Collins in his objections, but see farther room for improvement in Mr. Ferguson's, than what Mr. Collins has pointed out. In 1817, I made one with three wheels inside, but added two under the dial, to carry the hands direct: that is, the hour and minute hands only. It goes eight days, with a fall of twenty-one inches, and goes as correct as it is possible for any plain timepiece to do. In 1820, I made another with three wheels only. The hands are fixed on their own centres or axes, and go direct, but require to be set right separately. This clock goes eight days, with a fall of twenty-one inches.

I am, Sir, &c.

Newcastle-upon-Tyne.

G. S.

[A more detailed description of our Correspondent's Clocks would be acceptable.—ED.]

## FRUIT-GATHERER

SIR,—A year or two ago, as I passed through the town of Carlsruhe in Germany, I saw a machine for gathering fruit from the pendant branches of trees incapable of supporting a ladder, and out of the reach of the hand, which struck me as being both simple and well adapted to the purpose. Should it be considered so by you, and as worth the insertion in your valuable Magazine, the enclosed sketch of it is at your service. The season for putting it in use is now at hand, and possibly it may be turned to some effect by one or other of your numerous readers. The construction of it is this; A piece of flat, light board, about eight inches over, and, if you please, somewhat more in length, of either a round or an oval form, has a row of holes bored all round it near its edge, taking the shape of the board, and about the diameter of a quarter of an inch, into which are driven tight as many pegs, about six inches in length, which pegs are then bound together by a neat platting or banding of basket-work, about the breadth of a third of the height of the pegs, and worked down close to the bottom of the board. The part of the pegs above the wicker-work is to be cut "tooth fashion," for being applied to the stalk, between the fruit and the bearing spur of the tree, and by a wring of the machine, to draw it off into its interior. This head, if I may so express it, is attached to a light pole, of any convenient length for the purpose. The only improvement I would suggest is, that the bottom should be, in a great measure, cut out, and supplied by a coarse netted bag, which might remedy the chance of the fruit's rolling out, or of its getting bruised by falling on the board. It is possible that this contrivance may be in use in the apple districts of this country, but I have never met with it.

Yours, with much respect,  
Sept. 15, 1824. SUFFOLKIENSIS.

## MACHINE FOR RAISING STONES.

SIR,—“Northumbriensis,” p. 152, vol. II. may find an interesting de-

scription of the machine invented by Mr. Richardson, of Keswick, for raising stones, in the 8th Number of the Edinburgh Philosophical Journal, in which the firm retention of the cylindrical plug is satisfactorily attributed to the elastic power of the stone. I have seen four or five men, with a common triangle, and double and single block tackle (without a roller and levers,) raise a stone of nearly two tons weight, although the plug was not driven into the hole more than three-quarters of an inch. I apprehend, that the inferior elasticity of Portland and other soft stones would render the application of the machine uncertain in its effect, and extremely hazardous.

I am, Sir, &c.  
Bridport. E. N.

## TO OUR

## READERS AND CORRESPONDENTS.

To the use of the Sliding Rule, we shall shortly devote a few pages.

We shall be glad to hear again from Mr. T. S. D. of Bath.

Communications received from E. Nicholletts—J. M'Vey—J. J. Dartford—E. N.—Gulliot, of Portsea—P. Vauride—A Minor—Jas. Parry—Anonymous.

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